MILITARY SPECIFICATION

TURBINE FUEL, AVIATION, KEROSENE TYPE, GRADES JP-8

This amendment forms a part of MIL-T-83133B, dated 3 September 1987 and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 2

Delete "ASTM D 325" and substitute "ASTM D 235".

PAGE 3

Add: ASTM D 4052 Density and Relative Density of Liquids By Digital Density Meter

PAGE 4

3.1. delete and substitute:

"3.1 Materials. The fuel supplied under this specification shall be refined hydrocarbon distillate fuel oils containing additives in accordance with 3.3. The feed stock from which the fuel is refined shall be crude oils derived from petroleum, tar sands, oil shale or mixture thereof.

PAGE 5

Table I, Sulfur mercaptan, delete and substitute "Sulfur Mercaptan, wt. %".

Table I, Doctor test, delete "D 325" and substitute "D 235".

Table I, under Gravity and Density, delete "D 1298" and substitute "D 1298 or D 4052".

Table I, Smoke point, mm AND, delete "20.0" and substitute "19.0".

Table I, Napthalenes, delete and substitute "Naphthalenes, vol percent".

AMSC N/A FSC 9130

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

PAGE 5

Table I, heater tube deposit, delete "3" and substitute "≤3"

PAGE 6

Footnote 5/, delete "4.7.1.1" and substitute "4.5.2.1".

PAGE 8

3.4, delete and substitute:

"3.4 Workmanship. At the time of government acceptance, the fuel shall be clear and bright at the temperature of the fuel in the acceptance container or at 21°C (70°F) whichever is lower."

PAGE 11

6.6, delete "ASCC 15/1 - STANAG 1135" and substitute: "ASCC Air Standard 15/6, ASCC Advisory Publication 15/9, STANAG 1135 and STANAG 3747."

PAGE 13

Appendix A, 30, add:

"30.c Insert ring: A 47-m, diameter paper flow reducer ring with dimensions to give filtering area of 4.8 $cm^2$. (Millipore Corporation Part No. XX10 047 10.)".

Renumber 30.c, d, e, f, g, h, and i to 30.d, e, f, g, h, i, and j.

PAGE 15

Appendix A, 70.a (3), delete and substitute:

"(3) The fuel temperature shall be between 18° and 30°C (64° and 86°F). If artificial heat (i.e., a hot water bath) is used to heat the sample, erroneously high filtration times may occur, but this approach is allowed."

Custodians:
Army - MR
Navy - AS
Air Force - 11

Preparing activity:
Air Force - 11

Project 9130-0136

Review activities:
Army - MI, AV
Air Force - 68

MIL-T-83133B
3 SEPTEMBER 1987
SUPERSEDING
MIL-T-83133A
18 May 1979

MILITARY SPECIFICATION

# TURBINE FUEL, AVIATION, KEROSENE TYPE, GRADE JP-8

This specification is approved for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 SCOPE. This specification covers one grade of aviation turbine fuel.

| Grade | NATO Code No. | Description |
|---|---|---|
| JP-8 | F-34 | Kerosene type similar to ASTM D 1655 Jet A-1 fuel |
| | F-35 | Same as JP-8(F-34) but without the corrosion inhibitor/lubricity improver and the fuel system icing inhibitor additives (see 6.2.1) |

## 2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, deletions and any pertinent data which may be of use in improving this document should be addressed to: ASD/ENES, Wright-Patterson AFB OH 45433-6503 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 9130

SPECIFICATIONS

MILITARY

| | |
|---|---|
| MIL-T-5624 | Turbine Fuel, Aviation, Grades JP-4 and JP-5 |
| MIL-I-25017 | Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (Metric) |
| MIL-I-27686 | Inhibitor, Icing Fuel Systems |

STANDARDS

FEDERAL

| | |
|---|---|
| FED-STD-791 | Lubricants, Liquid Fuels and Related Products; Methods of Testing |

MILITARY

| | |
|---|---|
| MIL-STD-105 | Sampling Procedures and Tables for Inspection by Attributes |
| MIL-STD-290 | Packaging of Petroleum and Related Products |

QUALIFIED PRODUCTS LIST

| | |
|---|---|
| QPL-25017 | Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (Metric) |

(Copies of specifications, standards and qualified products lists required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS STANDARDS

| | |
|---|---|
| ASTM D 56 | Tester, Closed Flash Point By Tag |
| ASTM D 86 | Petroleum Products, Distillation of |
| ASTM D 93 | Tester, Closed, Flash Point by Pensky-Martens |
| ASTM D 130 | Copper Corrosion From Petroleum Products By the Copper Strip Tarnish Test, Detection of |
| ASTM D 156 | Petroleum Products, Saybolt Color of (Saybolt Chromometer Method) |
| ASTM D 240 | Heat of Combustion of Liquid Hydrocarbon Fuels By Bomb Calorimeter |
| ASTM D 325 | Standard Specification For Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent) |

| | |
|---|---|
| ASTM D 381 | Fuels by Jet Evaporation, Existent Gum In |
| ASTM D 445 | Liquids, Transparent and Opaque (And The Calculation of Dynamic Viscosity) Kinematic Viscosity of |
| ASTM D 976 | Calculated Cetane Index of Distillate Fuels |
| ASTM D 1094 | Water Reaction of Aviation Fuels, Test For |
| ASTM D 1266 | Petroleum Products, Sulfur in (Lamp Method) |
| ASTM D 1298 | Density, Specified Gravity or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method Standard Test Method For |
| ASTM D 1319 | Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption |
| ASTM D 1322 | Fuel, Aviation Turbine, Smoke Point of |
| ASTM D 1655 | Aviation Turbine Fuels, Specification For |
| ASTM D 1840 | Fuel Aviation Turbine by Ultraviolet Spectrophotometry, Napthalene Hydrocarbons In |
| ASTM D 2276 | Fuels, Aviation Turbine, Particular Contaminant In |
| ASTM D 2382 | Fuels, Hydrocarbon, Heat of Combustion of, By Bomb Colorimeter (High Precision Method) |
| ASTM D 2386 | Fuels, Aviation, Freezing Point Of |
| ASTM D 2550 | Fuels, Aviation Turbine, Water Separation Characteristics of |
| ASTM D 2622 | Petroleum Products, Sulfur In (X Ray Spectrographic Method) |
| ASTM D 2624 | Electrical Conductivity of Aviation and Distillate Fuels Containing A Static Dissipator Additive, Test Methods For |
| ASTM D 2887 | Boiling Range Distribution of Petroleum Fractions by Gas Chromotography, Test Method For |
| ASTM D 3227 | Mercaptan Sulfur in Gasoline, Kerosene, Aviation Turbine, and Distillate Fuels |
| ASTM D 3241 | Fuels, Aviation Turbine (JFTOT) Procedure), Thermal Oxidation Stability of, Standards Test Method For |
| ASTM D 3242 | Acidity In Aviation Turbine Fuel, Test Method For |
| ASTM D 3338 | Estimation of Heat of Combustion of Aviation Fuels, Method For |
| ASTM D 3343 | Method of Estimation of Hydrogen Content of Aviation Fuels |
| ASTM D 3701 | Hydrogen Content of Aviation Turbine Fuels by Low Resolution Nuclear Magnetic Resonance Spectrometry, Test Method For |
| ASTM D 3828 | Flash Point By Setaflash Closed Tester, Test Method For |
| ASTM D 3948 | Method for Determining Water-Separation Characteristics of Aviation Turbine Fuels by Portable Separometer |
| ASTM D 4057 | Standard Practice for Manual Sampling of Petroleum and Petroleum Products |
| ASTM D 4117 | Standard Method for Automatic Sampling of Petroleum and Petroleum Products |
| ASTM D 4294 | Test Method for Sulfur In Petroleum Products by Nondispersive X-ray Fluorescent Spectrometry |
| ASTM D 4308 | Standard Test Method for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter |
| ASTM E 29 | Recommended Practices for Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values |

(Application for copies should be addresssed to the American Society For Testing Materials, 1916 Race Street, Philadelphia PA 19103.)

DEPARTMENT OF TRANSPORTATION

49 CFR 170-189 Department of Transportation Rules and Regulations For The Transportation of Explosives and Dangerous Article

(Application for copies should be addressed to the Superintendent of Documents, US Government Printing Office, Washington DC 20402).

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Materials. Except as otherwise specified herein, the fuel shall consist completely of hydrocarbon compounds.

3.2 Chemical and physical requirements. The chemical and physical requirements of the finished fuel shall conform to those listed in table I.

3.3 Additives. The type and amount of each additive used shall be reported (see 6.2).

3.3.1 Antioxidants. Immediately after processing, add an approved antioxidant in order to prevent the formation of gums and peroxides after manufacture. The concentration of antioxidant to be added shall be:

a. No less than 17.2 mg nor more than 24.0 mg of active ingredient per liter of fuel (6.0 to 8.4 lb/1,000 barrels) to all JP-8 fuel that contains blending stocks that have been hydrogen treated.

b. At the option of the supplier, not more than 24.0 mg of active ingredient per liter of fuel (6.0 to 8.4 lb/1,000 barrels) may be added to JP-8 fuels that do not contain hydrogen treated blending stocks.

3.3.1.1 The following antioxidant formulations are approved:

a. 2,6-di-tert-butyl-4-methylphenol

b. 6-tert-butyl-2,4-dimethylphenol

c. 2,6-di-tert-butylphenol

Table I. Chemical and physical requirements and test methods.

| Property | Min | Max | Test Methods ASTM Standards |
|---|---|---|---|
| Color, Saybolt | | 1/ | D 156 |
| Total acid number, mg KOH/gm | | 0.015 | D 3242 |
| Aromatics, vol percent | | 25.0 | D 1319 |
| Olefins. vol percent | | 5.0 | D 1319 |
| Sulfur, total, wt percent | | 0.3 | D1266,D2622, D 4294 |
| Sulfur Mercaptan, wt., max % or | | 0.002 | D 3227 |
| Doctor test | | negative | D 325 |
| Distillation Temperature, °C 2/ (D 2887 limits given in parentheses) | | | D 86, D 2887 |
| Initial boiling point | | 1/ | |
| 10 percent recovered | | 205 (186) | |
| 20 percent recovered | | 1/ | |
| 50 percent recovered | | 1/ | |
| 90 percent recovered | | 1/ | |
| End point | | 300 (330) | |
| Residue, vol percent | | 1.5 | |
| Loss, vol percent | | 1.5 | |
| Flash point, °C (°F) | 38 (100) | 3/ | D93,D3828 3/ |
| Gravity, API OR | 37 | 51 | D 1298 |
| Density, kg/L at 15°C | 0.775 | 0.840 | D 1298 |
| Freezing point, °C (°F) | | -47 (-53) | D 2386 |
| Viscosity, at -20°C, centistokes | | 8.0 | D 445 |
| Net heat of combustion, MJ/kg | 42.8 | | D2382,D3338 4/ |
| or (Btu/lb) | 18,400 | | D 240 |
| Hydrogen content, wt percent | 13.4 | | D3701,D3343 |
| Smoke point, mm, OR | 25.0 | | D 1322 |
| Smoke point, mm AND | 20.0 | | D 1322 |
| Naphthalenes, vol percent, max | | 3.0 | D 1840 |
| Calculated Cetane Index | | 1/ | D 976 10/ |
| Copper strip corrosion, 2 hr at 100°C (212°F | | No. 1 | D 130 |
| Thermal stability | | | D 3241 5/ |
| change in pressure drop, mm Hg | | 25 | |
| heater tube deposit, visual rating | | 3 | |
| Existent gum, mg/100 ml. | | 7.0 | D 381 |
| Particulate matter, mg/L | | 1.0 | D 2276 6/ |
| Filtration time, minutes | | 15 | 6/ |

TABLE I. Chemical and physical requirements and test methods. (Cont'd)

| | | | |
|---|---|---|---|
| Water reaction interface rating | | 1b | D 1094 |
| Water separation index | 7/ | | D 2550, D3948 |
| Fuel system icing inhibitor, vol % | 0.10 | 0.15 | 8/ |
| Fuel electrical conductivity, pS/m 9/ | 200 | 600 | D 2624. D 4308 |

1/ To be reported - not limited

2/ A condenser temperature of 0° to 4°C (32° to 40°F) shall be used for the distillation by ASTM D 86. Distillation shall not be corrected to 760 mm pressure.

3/ ASTM D 93 is the referee method. Method IP170 is also permitted. The minimum flash point shall be 40°C by ASTM D 56, as it can be 1° - 2°C above those obtained by the other methods..

4/ When the fuel distillation test is performed using ASTM D 2887, the average distillation temperature, for use in ASTM D 3338 shall be calculated as follows:

$$V = (10\% + 50\% + 95\%)/3$$

5/ See 4.7.1.1 for ASTM D 3241 test conditions and test limits.

6/ A minimum sample size of one gallon shall be filtered. Filtration time will be determined in accordance with the procedure in Appendix A. This procedure may also be used for the determination of particulate matter as an alternate to ASTM D 2276.

7/ The minimum water separation index rating for JP-8 shall be 85 with all additives except the corrosion inhibitor/lubricity improver additive and the static dissipator additive or 70 with all additives except the static dissipator additive.

8/ Test shall be performed in accordance with method 5327, 5340 or 5342 of FED-STD-791.

9/ The conductivity must be in the range of 200 to 600 pS/m at ambient fuel temperature or 29.4°C (85°F), whichever is lower.

10/ Mid-boiling temperatures may be obtained by either ASTM D 86 or ASTM D 2887 to perform the cetane index calculation. ASTM D 86 values should be corrected to standard barometric pressure.

d. 75 percent min-2,6-di-tert-butylphenol
25 percent max tert-butylphenols and tri-tert-butylphenols

e. 72 percent min 6-tert-butyl-2,4-dimethylphenol
28 percent max tert-butyl-methylphenols and tert-butyl-dimethylphenols

f. 55 percent min 6-tert-butyl-2,4-dimethylphenol
45 percent max mixture of tert-butylphenols and ditert-butylphenols

g. 60 to 80 percent 2,6-dialkyphenols
20 to 40 percent mixture of 2,3,6-trialkylphenols and 2,4,6-trialkylphenols

h. 35 percent min 2,6-di-tert-butyl-4-methylphenol
65 percent max mixture of methyl-, ethyl-, and dimethyl-tert-butylphenols

i. 60 percent min 2,4-di-tert-butylphenol
40 percent max mixture of tert-butylphenols

j. 30 percent min mixture of 2,3,6-trimethylphenol and 2,4,6-trimethylphenol
70 percent max mixture of dimethylphenols

k. 55 percent min butylated ethylphenols
45 percent max butylated methyl-and dimethylphenols

l. 45 percent mix 4,6-di-tert-butyl-2-methylphenol
40 percent min mixture of 6-tert-butyl-2-methylphenol
15 percent max mixture of other butylated phenols

3.3.2 Metal deactivator. A metal deactivator, N,N'-disalcylidene-1,2 propanediamine or N,N'-disalicylidene-1,2-cyclohexanediamine may be blended into the fuel in an amount not to exceed two pounds active ingredient per 1,000 barrels of fuel (22 mg/gal (UK), or 5.8 mg/liter).

3.3.3 Static dissipater additive. An additive shall be added to the fuel in sufficient concentration to increase the conductivity of the fuel to within the range of 200 to 600 picosiemens per meter at the point of injection. The point of injection of the additive shall be determined by agreement between the purchasing authority and the supplier. The following electrical conductivity additives are approved:

a. ASA-3 marketed by Royal Lubricants Co., Inc., Roseland NJ.

b. Stadis 450 marketed by the E. I. DuPont de Nemours Co., Wilmington DE.

3.3.4 Corrosion inhibitor. A corrosion inhibitor conforming to MIL-I-25017 shall be blended into the JP-8 grade fuel by the contractor. The amount added shall be equal to or greater than the minimum effective concentration and shall not exceed the maximum allowable concentration listed in the latest revision of QPL-25017. The contractor or the transporting agency, or both, shall maintain and upon request make available to the Government evidence

that the corrosion inhibitors are equal in every respect to the qualified products listed in QPL-25017.

3.3.5 Fuel system icing inhibitor. The fuel system icing inhibitor is mandatory and shall conform to MIL-I-27686. The point of injection of the additive shall be determined by agreement between the purchasing authority and the supplier.

3.4 Workmanship. The finished fuel shall be visually free from undissolved water, sediment, or suspended matter and shall be clean and bright at the ambient temperature in delivery vehicle or pipeline at time of delivery.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or the purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize the submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material

4.2 Classification of inspections. The inspection requirements specified herein are classified as quality conformance inspection (see 4.4).

4.3 Inspection conditions. Requirements contained in table I shall not be subject to corrections for test tolerances. If multiple determinations are made, results falling within any specified repeatability and reproducibility tolerances may be averaged. For rounding off of significant figures, ASTM E 29 (as referenced in ASTM D 381) shall apply to all tests required by this specification.

4.4 Quality conformance inspection. Inspection shall be performed in accordance with method 9601 of FED-STD-791.

4.4.1 Inspection lot

4.4.1.1 Bulk lot. A bulk lot shall consist of an indefinite quantity of a homogeneous mixture of material offered for acceptance in a single isolated container.

4.4.1.2 Packaged lot. A packaged lot shall consist of an indefinite number of 55-gallon drums or small unit containers of identical size and shape offered for acceptance and filled from the isolated tank containing a homogeneous mixture of material.

4.4.2 Sampling plan

4.4.2.1 Sampling for verification of product quality. Each bulk or packaged lot of material shall be sampled for verification of product quality in accordance with ASTM D 4057 or ASTM D 4177, except where individual test procedures contain specific sampling instructions.

4.4.2.2 Sampling for examination of filled containers for delivery. A random sample of filled containers shall be selected from each packaged lot in accordance with MIL-STD-105 at inspection level II and acceptable quality level (AQL) of 2.5 percent defective. The samples shall be examined in accordance with 4.5.1.3.

4.5 Inspection methods

4.5.1 Examination of product

4.5.1.1 Visual inspection. Samples selected in accordance with 4.4.1 shall be visually examined for compliance with 3.4.

4.5.1.2 Examination of empty containers. Prior to filling, each empty unit container shall be visually inspected for cleanliness and suitability.

4.5.1.3 Examination of filled containers. Samples taken as specified in 4.4.2 shall be examined for conformance to MIL-STD-290 with regard to fill, closure, sealing, leakage, packaging, packing, and markings. Any container having one or more defects under the required fill shall be rejected. If the number of defective or underfilled containers exceeds the acceptance number for appropriate plan of MIL-STD-105, the lot represented by the sample shall be rejected.

4.5.2 Chemical and physical tests. Tests to determine conformance to the chemical and physical requirements (3.2) shall be conducted in accordance with the applicable test methods listed in table I and those specified herein.

4.5.2.1 Thermal stability. The thermal stability test shall be conducted in accordance with ASTM D 3241 (JFTOT). The heater tube shall be rated visually (see appendix A).

4.5.2.1.1 ASTM D 3241 test conditions

a. Heater tube temperature at maximum point: 260°C (500°F)

b. Fuel system pressure: 3.45 MPa (500 psig)

c. Fuel flow rate: 3.0 mL/minute

d. Test duration: 150 minutes

4.5.2.1.2 Acceptability criteria. The fuel sample is acceptable if all the following criteria are met:

a. The maximum differential pressure across the test filter does not exceed 25 millimeters of mercury.

b. The maximum visual rating of the heater tube deposits is less than a code 3, and the visual rating of the heater tube shows neither peacock type deposits (code P) nor abnormal type deposits (code A) (Appendix B, 10.6.3.1 and 10.6.3.2).

4.5.2.1.3 ASTM D 3241 reported data. The following data shall be reported:

a. Differential pressure in millimeters of mercury at 150 minutes, or time to differential pressure of 25 millimeters of mercury, whichever comes first.

b. Heater tube deposit visual rating code at the end of the test.

c. If a Mark 8A tube deposit rater (TDR) is available, the maximum SPUN TDR rating shall be reported.

4.6 Test reports. Test data required by 4.5.2 shall be reported in accordance with AFTO Form 476 (see 6.2.3).

PACKAGING

5.1 Packaging, packing, and marking. Packaging, packing, and marking shall be in accordance with MIL-STD-290. All fuel containers shall be marked with the actual flash point in $^{o}$F of the fuel contained therein.

5.2 Transportation of fuels. The transportation of the JP-8 fuel shall be in accordance with 49 CFR 170-189 Department of Transportation Rules and Regulations.

6. NOTES

6.1 Intended use. The fuel covered by this specification is intended for use in aircraft turbine engines. When authorized, JP-8 may be used in ground-based turbine engines and diesel engines.

6.2 Ordering data. Acquisition documents should specify:

6.2.1 This specification can also be used for the procurement of NATO F-35 by deleting paragrap hs 3.3.4 and 3.3.5 and the fuel system icing inhibitor requirements in table I.

6.2.2 Acquisition requirements

a. Title, number, and date of this specification

b. Quantity required and size containers desired

c. Level of packaging and packing required (see 5.1)

d. Location and injection method for addition of fuel system icing inhibitor and electrical conductivity additive.

6.2.3 Contract data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements list (CDRL) the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of DOD FAR Supplement, Part 27, Sub-Part 27.410-6 are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraph.

| Paragraph No. | Data requirements | Applicable DID No. | Options |
|---|---|---|---|
| 4.5.2 | Chemical and physical tests | | See 4.6 |

6.3 Precaution of mixing additives. To prevent any possible reaction between the concentrated forms of different additives (see 3.3), the fuel contractor is cautioned not to commingle additives prior to their addition to the fuels.

6.4 Subject term (key word) listing

Fuel

Grade JP-8

Kerosene

Turbine

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.6 International agreements. Certain provisions of this specification are the subject of international standardization agreement ASCC 15/1 and 15/6 and also NATO STANAG 1135. When amendment, revision, or cancellation of this specification is proposed which affects or violates the international agreement concerned, the prparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

Custodian:
Army - MR
Navy - AS
Air Force - 11

Review activities
Army - MI, AV
Air Force - 68

Preparing activity:
Air Force - 11

Project 9130-0131

APPENDIX A

METHODS FOR DETERMINATION OF
FILTRATION TIME AND TOTAL SOLIDS (PARTICULATE)

10. Scope. This method describes a procedure for determining simultaneously the filterability characteristics and solids contamination of jet fuel. The purpose is to detect and prevent contaminants in jet fuel which can plug ground system as well as aircraft filtration equipment.

20. Summary of method. 3.9 liters (one gallon) of jet fuel is filtered through a membrane filter in the laboratory. The time required to filter this volume is measured in minutes and solids content is determined gravimetrically.

30. Apparatus

a. Membrane filter: White, plain 47 mm diameter, nominal pore size 0.8 micron. The membrane must be approved by ASTM for use with ASTM D 2276.

b. Filtration apparatus: Of the type shown in ASTM D 2276, figure A3. It consists of a funnel and funnel base with a filter support such that a membrane filter can be securely locked or clamped between the sealing surfaces of the funnel and its base. The funnel and funnel base shall be of stainless steel or glass construction.

c. Vacuum flask: A minimum of 4 liters.

d. Vacuum system: That develops in excess of 67.5 kPa (20 inches of mercury) vacuum.

e. Oven: Of the static type (without fan assisted circulation) controlling to $90^{\circ}\pm5^{\circ}C$ ($194^{\circ}\pm9^{\circ}F$).

f. Forceps: Flat-bladed with unserrated nonpointed tips.

g. Solvent filtering dispenser: Containing a 1.2 micron maximum pore size filter in the delivery line.

h. Glass petri dish: Approximately 125 mm in diameter with removable cover.

i. Analytical balance: Single or double pan, the precision standard deviation of which must be 0.07 mg or better.

40. Preparation of apparatus and sample containers. All components of the filtration apparatus (except the vacuum flask), sample containers and their caps must be cleaned as described in A2.6.1.1 through A2.6.1.7 of ASTM D 2276. All metal parts of the filtration apparatus are to be electrically bonded and grounded, including the fuel sample containers. See ASTM D 2276 for other safety precautions.

50. Sampling. Obtain a representative one gallon sample as directed in A2.7 of ASTM D 2276. When sampling from a flowing stream is not possible, an all

level sample or an average sample, in accordance with ASTM D 4057 and/or ASTM D 4177 shall be permitted.

60. Test procedures

a Membrane filters shall be removed from the package and placed in an oven for a minimum of 15 minutes at 90°C. After preheating, but prior to weighing, the membrane filters shall be stored in a desiccator.

b. Each membrane filter shall be weighed. A filter weighing in excess of 90 mg will not be used in the test.

c. The membrane filter shall be placed directly over the insert ring. The top funnel shall be locked into place.

d. Immediately prior to filtering the fuel, shake the sample to obtain a homogeneous mix and assure that fuel temperature does not exceed 30°C (86°F). Clean the exterior or top portion of the sample container to insure that no contaminants are introduced. Any free water present in the fuel sample will likely invalidate the filtration time results by giving an excessive filtration time rating.

e. With the vacuum off, pour approximately 200 ml of fuel into the funnel.

f. Turn vacuum on and record starting time. Continue filtration of the 3.79 liters (one gallon) sample, periodically shaking the sample container to maintain a homogeneous mix. Record the vacuum in kPa (inches of mercury) 1 minute after start and again immediately prior to completion of filtration. Throughout filtration, maintain a sufficient quantity of fuel in the funnel so that the membrance filter is always covered.

g. Report the filtration time in minutes expressed to the nearest whole number. If filtration of 3.79 liters (one gallon) is not completed within 30 minutes, the test will be stopped and the volume of the fuel filtered will be measured. In these cases, results will be reported as 30+ minutes/volume of fuel filtered.

h. Report the vacuum in kPa (inches of mercury) as determined from the average of two readings taken in 60.f.

i. After recording the filtration time, shut off the vacuum and rinse the sample container with approximately 100 mL of filtered petroleum ether and dispense into the filtration funnel. Turn vacuum on and filter the 100 ml rinse. Turn vacuum off and wash the inside of the funnel with approximately 50 ml of filtered petroleum ether. Turn vacuum on and filter. Repeat the funnel rinse with another 50 ml of petroleum ether but allow the rinse to soak the filter for approximately 30 seconds before turning the vacuum on to filter the rinse. With vacuum on, carefully remove the top funnel and rinse the periphery of the membrane filter by directing a gentle stream of petroleum ether from the solvent dispenser from the edge of the membrance toward the center, taking care not to wash contaminants off the filter. Maintain vacuum after final rinse for a few seconds to remove the excess petroleum ether from the filter.

j. Using forceps, careully remove the membrane filter from the filter base and place in a clean Petri dish. Dry in an oven at 90°C (194°F) for 15 minutes with the cover on the Petri dish slightly ajar. Place dish in a dessiccator and allow to cool for a minimum of 15 minutes. If more than one sample is processed, cooling time will have to be increased. Reweigh the filter.

k. Report the total solids content in mg/liter by using the following formula:

$$\frac{\text{Weight gain of filter in mgs}}{3.785} = \text{mg/liter}$$

1. Should the sample exceed the 30-minute filtration time and a portion of the fuel is not filtered, the solids content is mg/liter will be figured as follows: Determine the volume of fuel filtered by subtracting the ml of fuel remaining from 3785.

$$\frac{\text{Weight gain of filter in mgs}}{\text{ml of fuel filtered x } 0.001} = \text{mg/liter}$$

70. Test limits

a. Filtration time:

(1) The maximum allowable filtration time shall be 15 minutes for Grade JP-8.

(2) The vacuum should exceed 67.5 kPa (20 inches of mercury) throughout the test (i.e., the differential pressure across the filter should exceed 20 inches of mercury).

(3) The fuel temperature shall be between 18° and 30°C (64° and 86°F). Do not artifically heat the sample (such as in a water bath) to bring the sample temperature within the required range. This has been found in some cases to give erroneous results.

b. Total solids: Maximum allowable particulate matter is 1.0 mg/liter.

80 NOTES

80.1 If it is desired to determine the filtration time and not the total solids content, perform the test by omitting steps 60.i, 60.j, 60.k, and 60.1.

80.2 It is permissible, but not required, to use a control filter for a specific analysis or a series of analyses. When this is accomplished, the procedures specified in A.2 of ASTM D 2276 apply.

APPENDIX B

HEATER TUBE DEPOSIT RATING

10. Visual method

10.1 Snap the upper end of the heater tube into the clamp of the adapter for the heater tube.

10.2 Push the heater tube against the stop of the adapter tube.

10.3 Slide the adapter with the heater tube over the guide rod into the tuberator equipped with a magnifying glass assembly.

10.4 Insert the ASTM color standard into the tuberator.

10.5 Rotate the adapter and position the heater tube so that the side with the maximum deposit is visible.

10.6 Within 30 minutes after completion of the test, visually examine the heater tube in a tuberator. The entire portion of the test section between the botton shoulder and the top shoulder of the heater tube shall be carefully examined using a magnifying glass in conjunction with the tuberator for any signs of discoloration, scratches, or other visually identified defects. When an area of the tube corresponds visually to an ASTM color standard, that color standard code number shall be recorded. If the area being rated has a color between two adjacent color standards, it shall be rated as the lighter (that is lower number) color standard. (NOTE: It is important that all light bulbs in the Tuberator are functioning as a change in light intensity can shift the rating significantly.) (NOTE: The person rating the tube should have normal ability to distinguish between colors; i.e., the rater should not be color blind.)

10.6.1 In rating the heater tube the darkest deposits govern and the code number repesentative of the darkest section, rather than the average deposit shall be reported.

10.6.2 If a spot or streak is found on the heater tube, it shall be carefully examined under various lighting conditions using a magnifying glass to determine if it is a deposit, a scratch, or tube defect (Note that the tube defects should have been found during the pretest inspection of the tube.) If the spot or streak is determined to be a scratch or tube defect, it shall be disregarded. If the spot or streak is a deposit, it shall be rated aginst the ASTM color standards, if larger in area than about 0.025 sq cm (0.004 square inch); i.e., approximately 1.5 mm x 1.5 mm (1/16 inch x 1/16 inch) square or an equivalent area. However, a streak deposit shall be ignored if less than 0.8 mm (1/32 inch) wide, regardless of length. Note the tube section is about 3 mm (1/8 inch) in diameter; thus a 1.5 mm (1/16 inch) wide spot is 1/2 the diameter of the tube test section and 0.8 mm (1/32 inch) wide streak is 1/4 the diameter of the tube test section.

10.6.3 If the heater tube has deposits that do not match the color standards, the following criteria shall be used:

10.6.3.1 If the deposit has peacock (rainbow) colors, rate this as code P (P for peacock). If some portion of the deposit does match the color standard, it shall be rated.

10.6.3.2 Deposits having abnormal colors (for example, blue or gray) shall have a rating of code A (A for abnormal color) assigned.

10.6.3.3 When reporting the overall tube rating, record the rating of the maximum deposit which matches the color standards plus P or A if the tube contains deposits which do not match the color standards. If the tube contains only P or A deposits, just report the appropriate letter(s); do not try to assign a numerical rating to a P or A deposit. Examples of how the rating procedure is to be used are given below:

Example 1 - The darkest deposits on the heater tube match color standard 3. Also present are peacock colors. Thus, the overall tube rating to be reported is 3P.

Example 2 - The heater tube has maximum deposits falling between color standards 2 and 3 and has no peacock or abnormal colors. The total tube rating is 2.

Example 3 - The heater tube matches color standard 1 except for an abnornal deposit which does not match the ASTM color standards. The overall tube rating to be reported is 1A.